Seamless Handover between CDMA2000 and 802.11 WLAN using msctp

Ashish Kumar Tripathi
Dr. C.V. Raman University
Bilaspur,Chhattisgarh,India
Ashishtripathi.cg@rediffmail.com
M.No 88172 - 53002

Raashid Ali
Dr. C.V. Raman University
Bilaspur,Chhattisgarh,India
ali.raashid@yahoo.com
M.No. 99071-78623

Neelam Sahu
Dr. C.V. Raman University
Bilaspur,Chhattisgarh,India
neelam.sahu16@rediffmail.com
M.No 97550 - 25925

***Abstract**:- The invention of mobile devices such as laptops, hand-held computers, and cellular phones has changed the whole Internet world. The main feature of mobile devices is that they can access the Internet wirelessly by different air interfaces using different technologies while roaming. This makes mobile devices become increasingly popular. However, the traditional Internet does not support any needed features and architectural structures for mobility management.*

When a mobile device comes to the Internet, it will move from one sub-network to another sub-network. However, the IP address of the mobile device will keep unchanged and the IP address can not reflect the new location due to the traditional addressing scheme of the Internet. As a result, the packets from the new location will not be routed to the destination and the packets to the new location of the mobile device will be forwarded to the old location by the traditional Internet protocols.

Keywords: Mobile IP , *Wireless Access Interfaces, SCTP, DAR, Mobile IP, Session Initiation Protocol*

1. Introduction

The invention of mobile devices such as laptops, hand-held computers, and cellular phones has changed the whole Internet world. The main feature of mobile devices is that they can access the Internet wirelessly by different air interfaces using different technologies while roaming This makes mobile devices become increasingly popular. However, the traditional Internet does not support any needed features and architectural structures for mobility management. The traditional addressing scheme of the Internet has been designed based on the assumption that any node only has one fixed and permanent IP address in the Internet.

Consequently, any node could be easily identified by this unique IP address and its location is directly recognized in the Internet

When a mobile device comes to the Internet, it will move from one sub-network to another sub-network. However, the IP address of the mobile device will keep unchanged and the IP address can not reflect the new location due to the traditional addressing scheme of the Internet. As a result, the packets from the new location will not be routed to the destination and the packets to the new location of the mobile device will be forwarded to the old location by the traditional Internet protocols. All the connections for the mobile device will be lost during the movement and this is regarded as IP mobility management issues. IP mobility issues have been regarded as the core technology required to provide seamless mobility in the wireless mobile networks such as WLAN, 3G Cellular networks. IP mobility issues can be classified into Location Management and Handover Management. Location management is used to identify the current location of mobile devices and also to keep the track of their location as they move in the network while handover management is to maintain the on-going connections no matter where they move in the network. In this thesis, we will focus on the latter: performance of handover management. The main objective of the handover management is to minimize the service disruption by reducing data loss and handover latency during handover period.[2].

Handover management can be implemented in different layers of the Internet architecture based on the OSI-reference model. The OSI model [3] is based on a proposal developed by the International Standards Organization as the first step toward international standardization of the protocols used in the various layers of communication architecture. The OSI model is designed as a 7-layer hierarchy, with each layer responsible for a specific task.

The two lowest layers handle issues concerning physical medium and raw data transmission.The two highest layers cover presentation and application problems. Currently, the focus of mobility management is not from these four layers while there are quite a few mobility management protocols developed from the rest three layers Network layer provides switching and routing technologies and creating logical paths to transmit data from one endpoint to another endpoint. Internet Protocol (IP) protocol is working this layer to provide routing and forwarding functions , as well as addressing, internetworking, error handling, congestion control and packet sequencing. Most IP mobility researches focused on this layer at the beginning and there are many brand new protocols in this layer which can support IP mobility management such as Host Identity Payload (HIP), Handoff Aware Wireless Access Internet Infrastructure (HAWAII), Cellular IP, and Intra-domain Management Protocol (IDMP). [4] [5] [6]. The most significant protocol in this layer for mobility management is mobile IP (MIP) and it has been used very commercially and widely.

The function of transport layer is to provide transparent transfer of data between two endpoints. Moreover, it is responsible for end-to-end error recovery and flow control. Stream Control Transmission Protocol (SCTP) is a new Internet Engineering Task Force (IETF) proposed standard protocol for the transport layer. It is the third protocol for the function of transport layer is to provide transparent transfer of data between two endpoints. Moreover, it is responsible for end-to-end error recovery and flow control. Stream Control Transmission Protocol (SCTP) is a new Internet Engineering Task Force (IETF) proposed standard protocol for the transport layer. It is the third protocol for Session layer establishes, manages and terminates the connections between the applications running on the endpoints. During the session establishment, the endpoints need to exchange the location information. Accordingly, when a mobile device in a session moves to other location, it will send the new location to the other endpoint to establish a new session. Based on this, Session Initiation Protocol (SIP) has been designed recently to support IP mobility.

2. Wireless Access Interfaces -- CDMA2000 and 802.11b WLAN

IEEE 802.11 WLAN has gained increasing recognition over wired networking in recent years and it makes the communications world progressively more mobile. On the other hand CDMA2000 is a significant advance in the evolution of cellular wireless telecommunications into 3G networks. Both of these two technologies employ wireless access air interfaces for data communication; however they have vastly different characteristics. This chapter describes these two wireless technologies in terms of network architectures and highlight differences between them.

- Overview of CDMA2000
- Overview of 802.11b WLAN
- WLAN and CDMA2000

3. Mobile SCTP and its Advantages for Mobility Management

we describe three mobility management solutions: a network layer approach, Mobile IP (MIP) including MIPv4 and MIPv6, a transport layer approach,mSCTP and an application layer approach, Session Initiation Protocol (SIP). Firstly, thenew features of SCTP and the DAR extension of SCTP are covered to examine mSCTP handover mechanism. Then, the basic mechanism and handover procedure of MIP and SIP are described. At the end, a comparison of these three mobility protocols shows the advantages of mSCTP for mobility management.

Mobile SCTP is the transport layer handover solution based on the multi-homing feature of SCTP and its dynamic address reconfiguration extension (DAR). Multi-homing is the concept that SCTP endpoints can hold multiple IP addresses while DAR extension provides mSCTP a method to reconfigure the status of IP address on an ongoing SCTP association.

SCTP is another general-purpose transport protocol for IP network data communications and it is regarded as the third transport protocol after TCP and UDP

Using the multi-homing feature, a SCTP endpoint can use multiple IP addresses for an association with other endpoint at a given moment. The problem is that basic SCTP does not have a function to add a newly coming IP address to the existing association or change the backup IP address to be primary IP address without disconnecting the endpoint. These problems motivated the DAR extension of SCTP. DAR extension defines three major parameters to change the status of IP address for an association: Add IP Address (Add-IP), Set Primary IP Address (Set-Primary-IP) and Delete IP address (Delete-IP). Also, two special chunks are defined in the DAR extension to carry these parameters between SCTP endpoints. Thus the DAR extension provides the following function to an SCTP association [16]:

1. Dynamic addition of a newly coming IP addresses to an existing association.
2. Dynamic deletion of IP an old and unused addresses from an existing association.
3. Change the primary IP address of an existing association.

- DAR extension parameters
- DAR extension chunks
- Mobile IP
- Session Initiation Protocol
- Mobility protocol comparison

4.Mobile SCTP Mobility Management between CDMA2000 and 802.11 WLAN

Handover delay

Handover delay is the most significant measurement for the handover. It can affect other handover quality metrics like packet loss and the end-to-end throughput. Handover delay is defined as the period of time between two given moments. The first one is the moment when the MN move to a new subnet and the current primary IP address becomes inaccessible or less preferred for data transmission. The second one is the moment when the endpoint switches the primary IP address to the new IP address the MN obtains from the new subnet. More specifically, for our project, the handover delay when a MN moves into a WLAN is the period of time between the moment when the MN receives the last packet using CDMA_IP and the moment when the MN receives the first packet using WLAN_IP. On the other hand, the handover delay when a MN moves away from the WLAN is the period of time between the moment when the MN receives the last packet using WLAN_IP and the moment when the MN receives the first packet using CDMA_IP.

- **Handover Throughput**
- **Handover Packet Losses**

Packet loss is the total number of lost pockets during handover epochs. It also depends on the handover delay. Since we can make the packet size fixed, say S, the packet losses can be defined as the total data loss divided by the packet size. In the previous section, we already defined the data loss during handover, so the packet loss for handover can be expressed as follows:

Smsctp 1 –Pmsctp *(T Msctp1/Ts)/ S

Smsctp 2–Pmsctp *(T Msctp2/Ts)/ S

Where Smsctp1 is the packet loss for handover from CDMA2000 to WLAN and Smsctp2 is the packet loss for handover from WLAN to CDMA2000. From this equation, we can draw the same conclusion to the MN-to-CN transmission throughput. When the handover is seamless, the handover delay is almost zero and almost no packets are lost during handover, whereas when the handover delay is high, many packets are lost during handover. The retransmission of these packets cause network congestion and lowers the service quality

5 Testbed and Software Development

first describe how to set up our handover testbed between CDMA2000 and WLAN networks, which includes how to configure mSCTP as well as the CDMA2000 and WLAN interfaces on a Linux platform. Then the handover software is presented, including the core ideas and the software requirements

- **Testbed development**
- **Linux Setting**
- **Hardware Settings**
- **CDMA2000 Gtran Modem**
- **Dlink USB WiFi Card**
- **Server setting**
- **Software development**

6. Results and Discussion

We have presented the development of our handover testbed and its software in the last chapter. In this chapter, we focus on the performance of mSCTP handover on the testbed. Handover delay, end-to-end throughput and packet loss are the major parameters for mSCTP handovers. Total handover delay: In order to obtain a handover delay from the testbed. We use ethereal [30] to capture all the packets coming into or going out from the server. The handover delay is measured by the time difference between the time a handover it triggered and the time a data packet is received successfully after the handover period. End-to-end throughput: From the trace of all the packets for the server, we account the amount of packets transmitted by TSN.Packet loss: The packet loss is measured by counting the number of packets loss during the handover period.

1. References

[1] C. Perkins, “IP mobility support”, IETF RFC 3344,
[2] Koh, S., Lee, M., Riegel, M., Ma, M. and M. Tuexen, "Mobile SCTP for Transport Layer Mobility", Internet draft, draftsjkoh-sctp-mobility-03.t
[3] http://en.wikipedia.org/wiki/OSI_model
[4] R. Ramjee, T. La Porta, S. Thuel, and K. Varadhan, “IP Micro-Mobility support through HAWAII”, IETF Internet Draft, draft-ramjee-micro-mobility-hawaii-01.txt, July 2000.
[5] M.Ratola “Which layer for mobility? Comparing HIP, MIPv6 and SCTP.” Helsinki University, April, 2004.
[6] A.G.Valko, “ Cellulary IP : A New Approach to Interne

[7] Pablo Brennel, “A technical Tutorial on IEEE802.11 protocol”, 1997 http://www.sss-mag.com/pdf/802_11tut.pdf
[8] Gast, M. S., “802.11 Wireless Networks – The Definitive Guide”, 1st edition, 2002.
[9] Crow, B. P. et al.: “IEEE 802.11 Wireless Local Area Networks”, IEEE Communications Magazine, 1997, vol35, issue 9, p116-126.

[11] “an overview of IS-95 and CDMA2000”, July 2002 http://www.geocities.com/rahulscdmapage/Technical/Chapter4.pdf
[12] R. Stewart, Q. Xie, K. Morneault, C. Sharp, H. Schwarzbauer, T. Taylor, I. Rytina, M. Kalla, L. Zhang, and V. Paxson, “Stream control transmission protocol” IETF RFC 2960,2000
[13] Randall. R. Stewart and Qiaobing Xie. Stream control transmission protocol (sctp): A reference guide. Addison Wesley, 2002.
[14] Shaojian Fu and Mohammed Atiquzzaman, “Sctp: State of the art in research, products, , and technical challenges”, IEEE Communications Magazine, 42(4):64–76,April 2004.
[15] Ong, L. et al.: “An Introduction to the Stream Control Transmission Protocol (SCTP)”, RFC 3286, 2002.